

WHAT IS CLAIMED IS:

1. A cleaning device for cleaning at least one object comprising:
an inner vessel configured to contain a first liquid and the object;
an external vessel configured to contain a second liquid and the inner vessel,
wherein the second liquid is acoustically coupled to the first liquid; and
at least one transducer acoustically coupled to the external vessel and
configured to generate acoustical energy which is transferred to the
object;
wherein the first liquid has a dissolved gas concentration of a first gas and the
second liquid has a dissolved gas concentration of a second gas.
2. The cleaning device of claim 1, wherein the at least one transducer acoustically
operates in one of an ultrasonic frequency and a megasonic frequency.
3. The cleaning device of claim 1, wherein the first liquid and the second liquid
comprise water.
4. The cleaning device of claim 1, wherein the first gas and the second gas
comprise air.
5. The cleaning device of claim 1, wherein the dissolved gas concentration of the
first gas in the first liquid and the dissolved gas concentration of the second gas in
the second liquid is substantially constant during application of the acoustic energy
to the object.

6. The cleaning device of claim 1, wherein the dissolved gas concentration of the first gas in the first liquid is greater than the dissolved gas concentration of the second gas in the second liquid.
7. The cleaning device of claim 1, wherein the first liquid is at a first temperature and the second liquid is at a second temperature.
8. The cleaning device of claim 1, wherein the first liquid is at a first flow rate and the second liquid is at a second flow rate.
9. The cleaning device of claim 1, wherein the inner vessel is an inner tank having an open top end and the external vessel is an external tank having an open top end.
10. The cleaning device of claim 1, wherein the inner vessel is an inner conduit having a first end and a second end, the first liquid transfers the object from the first end to the second end; and wherein the external vessel is an external conduit having a first end and a second end, the second liquid flows from the first end to the second end.
11. The cleaning device of claim 1, wherein the inner vessel is an open top inner channel having a first end and a second end, the first liquid transfers the object from the first end to the second end; and wherein the external vessel is an open top external channel having a first end and a second end, the second fluid flows from the first end to the second end.

12. A method of acoustically cleaning at least one object, the method comprising:
controlling a dissolved gas concentration of a first gas in a first liquid;
passing the first liquid through an inner vessel, the inner vessel configured to
contain the object;
controlling a dissolved gas concentration of a second gas in a second liquid;
passing a second liquid through an external vessel configured to contain the
inner vessel, the second liquid acoustically coupled to the first liquid;
and
generating an acoustical energy which is transferred to the object.
13. The method of claim 12, wherein generating an acoustical energy comprises
generating an acoustical energy in one of an ultrasonic frequency and a megasonic
frequency.
14. The method of claim 12, wherein controlling the dissolved gas concentration
of the first gas in the first liquid further comprises:
degassing the first liquid with a first exchanger;
introducing a desired level of the first gas into the first liquid with a second
exchanger.
15. The method of claim 14, wherein introducing the desired level of the first gas
into the first liquid further comprises providing the desired level of the first gas that
is greater than a desired level of the second gas.
16. The method of claim 12, wherein controlling the dissolved gas concentration
of the second gas in the second liquid further comprises:

degassing the second liquid with a first exchanger;
introducing a desired level of the second gas into the second liquid with a
second exchanger.

17. The method of claim 16, wherein introducing the desired level of the second gas into the second liquid further comprises providing the desired level of second gas that is less than a desired level of the first gas.
18. The method of claim 12, wherein passing the first liquid through an inner vessel further comprises passing the first liquid through an inner conduit in a first direction, the first fluid transferring the at least one object in a first direction from a first end of the inner conduit to a second end of the inner conduit.
19. The method of claim 12, wherein passing the first liquid through an inner vessel further comprises passing the first liquid through an inner channel in a first direction, the first fluid transferring the at least one object in a first direction from a first end of the inner channel to a second end of the inner channel.
20. A cleaning device for cleaning at least one object comprising:
an inner vessel configured to contain a first liquid and the object;
an external vessel configured to contain a second liquid and the inner vessel,
wherein the second liquid is acoustically coupled to the first liquid; and
at least one transducer acoustically coupled to the external vessel and
configured to generate acoustical energy which is transferred to the
object;

wherein the first liquid has a dissolved gas concentration of a first gas that is greater than a dissolved gas concentration of a second gas in the second liquid.

21. A system for controlling a dissolved gas concentration in a liquid, the system comprising:

an inlet configured to receive a supply liquid into the system, the supply liquid having an unknown concentration of dissolved gas;

a first exchanger operably coupled to the inlet and configured to degas the supply liquid; and

a second exchanger operably coupled to the first exchanger and configured to introduce a predetermined gas concentration to the degassed supply liquid.

22. The system of claim 21 including an outlet operably coupled to the second exchanger and configured to discharge the supply liquid having the predetermined gas concentration into a cleaning device.

23. The system of claim 21 including at least one filter for removing particles from the supply liquid.

24. The system of claim 20 including a temperature controller for heating or cooling the supply liquid to a predetermined temperature.

25. The system of claim 21 including a vacuum operably coupled to the first exchanger and the second exchanger, the vacuum configured to apply a vacuum to the first exchanger and to the second exchanger.

26. The system of claim 21 including a first vacuum operably coupled to the first exchanger and a second vacuum operably coupled to the second exchanger, the first vacuum configured to apply a vacuum to the first exchanger and the second vacuum configured to apply a vacuum to the second exchanger.